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A THREE-YEAR EXPERIMENT WITH COMBINED DIPHTHERIA TOXOID--PERTUSSIS VACCINE

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TOXOID for protection against diphtheria is now universally adopted and and is known to be a good immunizing agent. But our armament for the control of whooping cough, through the use of a biological product, has long been felt to be deficient and we have of such a product a pressing need.

In the more recent years, fifteen studies were published covering the incidence and mortality from whooping cough in a total of 14,596 vaccinated persons—children and adults—and in 11,763 controls (1). Some vaccines were thought to be quite good (2), others definitely poor (3). The number of studies and the divergency of results confused the issue. Our experiment was undertaken to bring more light on this question and to add to our knowledge of massive immunization.

After the 1942 provincial epidemic of whooping cough, it was decided to experiment with a specific vaccine in a large group. Our choice was pertussis vaccine combined with diphtheria toxoid produced by the Connaught Medical Research Laboratories, University of Toronto. Diphtheria toxoid is a well-known product and Connaught's pertussis vaccine gave good results in animal experimentation. The combination of vaccines is nothing new and it is admitted that the addition of an heterelogous substance to toxoid increases its power of producing immunity (4).

Our experiment began in 1943, to continue until a new epidemic would again cover the Province. The original group chosen for the experiment consisted of the Counties of Maskinongé, Saint-Maurice, Trois-Rivières, Cham-

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plain and Montmagny. On December 31, 1943, Saint-Maurice had to be taken out of the group for reasons irrelevant to the experiment and from January 1, 1944, the City of Montreal became part of the experimental group, continuing to the end of the study. The experiment began on January 1, 1943, and ended December 31, 1945.

An epidemic of whooping cough usually breaks out in a large agglomeration, to spread later in the rural sections of the population. The City of

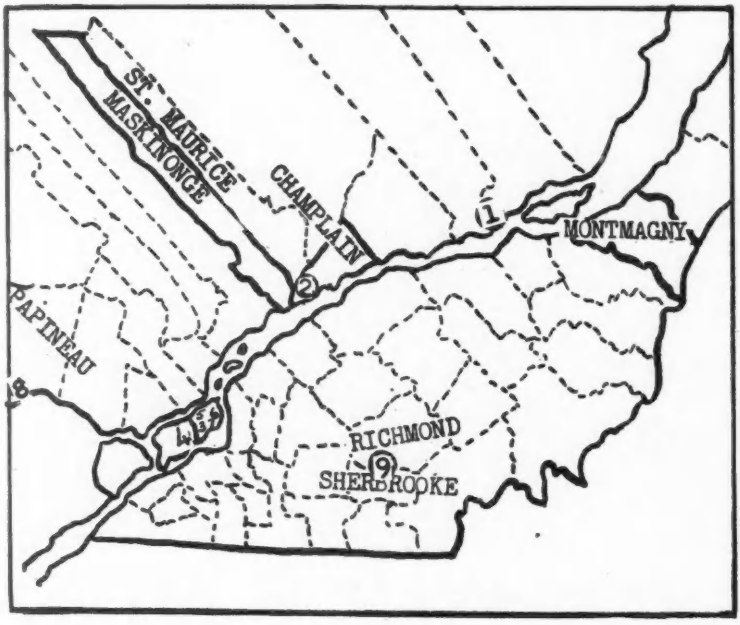

FIGURE I

LOCALE OF THE COUNTIES PARTICIPATING IN THE COMBINED DIPHTHERIA TOXOID-PERTUSSIS VACCINE EXPERIMENT

Cities		*Median Population, 1944*	
(1) Quebec	(6) Westmount	Montreal	972,000
(2) Trois-Rivières	(7) Verdun	Champlain	34,724
(3) Montreal	(8) Hull	Maskinongé	14,490
(4) Lachine	(9) Sherbrooke	Montmagny	22,605
(5) Outremont		Trois-Rivières	45,885
		Total	1,089,704

Montreal is one-fourth the total population of the Province of Quebec, and it was to be expected, as it actually happened, that it would be the first focus of the next epidemic, which would then spread, as such epidemics usually do, from west to east. On the road of invasion of the disease, two partitions were erected: one on the North Shore of the St. Lawrence River—Maskinongé, Trois-Rivières and Champlain—and the other one on the South Shore, the County of Montmagny. These two groups of counties, located in the central part of the Province, were bound to be attacked by whooping cough.

The median population (1944) of the selected area was 1,089,704, and the number of children from 0 to 9 years of age, 183,682. These 183,682 children were our experimental material.

The protocol of the work was set up before a single injection was given and we adhered to it very faithfully. The combined vaccination was offered to the five units of population, with the representation that it would protect the children against diphtheria and would give them some defence against whooping cough. Children under six months of age and those who had suffered from whooping cough were not accepted; children over ten years of age were not invited, and only a few insisted on the combined vaccination. It was materially impossible to keep as a control every second child who would come to us: thus, it was decided that the protected group, during the next epidemic, would be the children who would then have received their three doses of the combined product and that the control group would be "the balance of the 183,682 children" of the five units of population who would not have received their three doses; namely, children who had had whooping cough, infants under six months, children who had not received one single injection of the combined product, and children who had received only one or two such injections.

Infants were given one and a half cc. at the first injection and two cc. at the others; all the other children were given three doses of two cc. each, with an interval of one month between the injections. Early, in the first year of the experiment, we discontinued giving one cc. in each arm and the two cc. were administered in the same arm: the reaction is not more severe and the child has not to watch for a second prick of the needle and does not cry. In the first clinics that were held, the first four or five children who had received one injection in each arm would cry their heart out and start the other waiting children in the concert: the two-cc. dose stopped this disturbing situation altogether.

We again found out early that immunization late in the afternoon gave a lower percentage of reactions than when the injections were given in the morning. The great majority of the reactions appeared after the first injection and usually children who reacted after the first dose did not have any trouble after the two last injections.

With fluid toxoid there are practically no reactions in infants; with the combined product more reactions were observed in the babies than in the children 6 or 8 years old. About twenty-five per cent will show on the arm an area of redness and tenderness, for which cold, wet dressings are prescribed; there is fever, malaise and fatigue for 12 to 18 hours in about 10 per cent of the cases. Very often, babies will be fretful and restless for two hours the first evening. It was observed, without explanation, that after some clinics the percentages of local and general reactions varied widely: in some instances more than half the children were reactors, when in another place their number was insignificant. The mother is warned of all this and she is not frightened by these minor symptoms.

Another general reaction was observed in about 2 per cent of the cases: after the first dose the child will develop a characteristic and spasmodic cough, closely related to whooping cough, but much less severe, without whoop or

vomiting or suffocation. This is not a cold nor a bronchitis: there is no temperature and there are no clinical signs in the lungs. But mothers and doctors who know whooping cough cannot be mistaken and the parents themselves have designated for us this general reaction with a suitable and appropriate name: "coqueluchette". This cough lasts about ten days and disappears without any treatment.

TABLE I

SUMMARY OF EXPERIMENTAL WORK WITH COMBINED DIPHTHERIA TOXOID—PERTUSSIS VACCINE 1943–1945

	Champlain	Maskinongé	Montreal	Montmagny	Trois-Rivières	Total
Median population	37,724	14,490	972,000	22,605	45,885	1,089,704
Number of children 0 to 9	7,326	4,112	157,792	4,770	9,682	183,682
No. of protected children, 3 doses	2,321	798	32,182	1,860	1,027	38,188
No. of children partially protected, i.e. having received less than 3 doses	43	508	9,648	234	98	10,531
No. of protected children having received a recall dose	1,088	386	1,325	219	68	3,086

During the first year of the experiment, 1943, a total of 1,119 children received the three doses of combined vaccine, 16,546 in the second year and in 1945, the last year, 20,573—a grand total of 38,188 protected children. Out of this number, 3,086 received a booster dose during the last two years. Incidentally, this last group did not have a single case of diphtheria or whooping cough.

The combined vaccination was very popular with the mothers: they asked for it; and we got from them wonderful co-operation all through the experiment. We were faithfully notified of the observed reactions and of whooping cough cases in the vicinity, in the family or in the vaccinated children. We are sure that we have had the best reporting possible in this group, and that notification from the balance of the Province was far behind that of the experimental group.

TABLE II

AGE DISTRIBUTION OF PROTECTED CHILDREN

Age group	Number protected	Per cent of Total
−1 year	11,304	29.6
1 year	5,041	13.2
2	4,048	10.6
−3	20,393	53.4
3	2,940	7.7
4	2,329	6.1
5	2,368	6.2
6	4,239	11.1
7	2,750	7.2
8	1,853	4.8
9	955	2.5
10+	381	1.0
All ages	38,188	100.0

Out of our total number of vaccinated children, nearly 30 per cent were between six months and one year of age when vaccinated and 53.4 per cent were protected before three years of age. The percentage distribution decreased regularly with each age group as the children were getting older, with the two exceptions for the age groups 6 and 7, which are the first school years, to come down to 2.5 in the 9-year-old students and to 1.0 per cent for children 10 and over. It may be said here that half of the cases of whooping cough which occurred in the vaccinated children—that is, 32 cases out of 64—were in children less than 3 years of age.

Though susceptibility to whooping cough is general to all children, those under 7 years of age are more susceptible to attack and those under 2 years of age to fatal attack (5). It was therefore felt that we should stress the necessity of protecting the younger ages to reduce mortality.

In 1945, a new epidemic of whooping cough again invaded the Province: we did not know then what would be the outcome of our work; but we felt very strongly that this epidemic would be the crucial test of the vaccine and of our technique.

Against our expectation, the region of Montreal was not stricken as severely as in previous epidemics: however, we would not want to ascribe this lower incidence to the value of the vaccine. The epidemic covered the whole Province begininng in October 1944 and ending in the fall of 1945, with a remission during the summer months.

As a background to our study, in Table III and Figure II are presented data on mortality from whooping cough and diphtheria, in the Province of Quebec, for twenty years, from 1926 to 1945 inclusive.

TABLE III

MORTALITY RATES FROM WHOOPING COUGH AND DIPHTHERIA IN THE PROVINCE OF QUEBEC 1926–1945

Year	Rate per 100,000 population		Year	Rate per 100,000 population	
	Whooping Cough	Diphtheria		Whooping Cough	Diphtheria
1926	23.1*	14.0	1936	6.0	5.1
1927	20.8*	17.6	1937	14.1*	8.9
1928	11.2	15.2	1938	8.5	9.5
1929	10.4	14.5	1939	7.0	6.8
1930	17.0*	10.9	1940	7.9	4.2
1931	11.3	10.6	1941	7.1	4.0
1932	8.0	6.5	1942	9.6*	3.6
1933	9.1	4.2	1943	6.0	4.4
1934	13.5*	4.1	1944	2.7	5.3
1935	13.0*	4.9	1945	7.8*	5.0

*Epidemic of whooping cough.

From 1926 to 1931 inclusive, mortality from diphtheria was abnormally large. Immunization of children with toxoid began in 1931 and in the following years the mortality decreased by 50 per cent. Mortality from whooping cough during these twenty years has constantly been higher than the mortality from diphtheria, with a few exceptions.

The mortality rates, both for whooping cough and diphtheria, for the year 1945 are provisional.

A summary of the principal features of Table III and Figure II is as follows:

(1) The mortality from whooping cough, in epidemic years, decreased from 23.1 per 100,000 population in 1926 to 7.8 in 1945.

(2) The mortality from whooping cough, in non-epidemic years, also went down from 11.2 in 1928 to 2.7 in 1944.

(3) The mortality from diphtheria decreased from 17.6 in 1927 to 5.0 in 1945; diphtheria may be said to have been prevalent from 1936 to 1940.

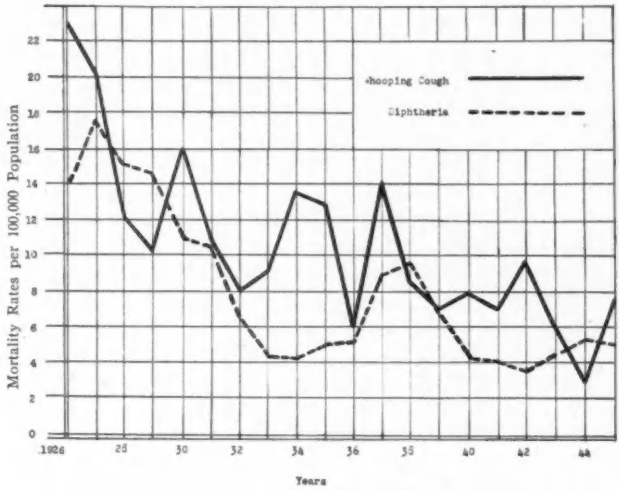

FIGURE II

MORTALITY RATES FROM DIPHTHERIA AND WHOOPING COUGH IN THE PROVINCE OF QUEBEC, 1926-1945

(4) Six epidemics of whooping cough were observed during this twenty-year period: an asterisk marks the rates of the epidemics in Table III.

(5) Two epidemics of whooping cough covered two years, namely 1926-1927 and 1934-1935.

(6) The interval between epidemics is from three to five years.

(7) The combined vaccination experiment began in 1943, the year following an epidemic, and ended in 1945, which was also epidemic for whooping cough.

The morbidity and mortality rates from whooping cough and from diphtheria will now be studied, for the three years of the experiment, 1943-1945. A first comparison will be made between the experience of the experimental group and the Province less the experimental group, and then between the protected children and the non-protected children of the experimental group. The first Table (IV) presented is only included to impart a general knowledge of the situation in the Province during the years of the experiment.

Table IV is brought in just to show both situations in these two groups respective to the two diseases, as it is not to be expected that the protection of 38,188 children can affect materially rates based on a population five times higher.

We only want to point out two indications of interest:

(*a*) The morbidity rate for whooping cough is more than twice as high in the experimental group as in the balance of the Province, on account of a better notification of cases.

(*b*) The mortality rates, both for diphtheria and whooping cough, are twice as high in the balance of the Province as in the experimental group.

TABLE IV

MEAN MORBIDITY AND MORTALITY RATES, FROM DIPHTHERIA AND WHOOPING COUGH, IN THE EXPERIMENTAL GROUP AND IN THE PROVINCE LESS THE EXPERIMENTAL GROUP, 1943–1945

Cases and deaths are average numbers for 3 years	Experimental Group		Province less Experimental Group	
Children 0-9 years.....	183,682		512,792	
Rates are per 100,000 specified population	Whooping Cough	Diphtheria	Whooping Cough	Diphtheria
(Mean)				
Number of cases.....	2,248	198	2,616	1,596
Morbidity rates.....	1,223.8	107.8	510.1	311.2
Number of deaths.....	23	28	155	161
Mortality rates.....	12.5	15.2	30.2	31.4

There was no indication that the case fatality rate was higher in the experimental group; thus we have to admit that the reporting of cases in the balance of the Province was not adequate.

In this experimental group of 183,682 children, we knew in a very precise manner about cases and deaths that could and did happen. These children, protected and non-protected, who lived in the same environment were equally exposed to the same endemic diphtheria and to the same epidemic of whooping cough. Not a single measure, the combined vaccination excepted, was taken to keep the vaccinated children safe from infection: they went to school, played in the street or the park and even lived in the same homes with their control companions. Nevertheless over a period of three years, the morbidity rate from diphtheria, per 100,000 specified population, was 1.8 in the protected group against 136.0 in the control group; the morbidity from whooping cough was 55.8 in the vaccinated against 1,574.6 in the non-vaccinated. It must here be added that the control group included the children who had suffered from whooping cough in the 1942 epidemic or in previous years and the children who had received one or two injections of the combined vaccine but who had not been completely immunized; the control group could not be said to have been entirely "non-protected" and it might have been hard to beat with a poor biological product. Along the same lines, quite a number of children of the

control group had previously been immunized against diphtheria with fluid toxoid.

We did not have, over the three years, a single death either from diphtheria or from whooping cough in the protected group, while the control group experienced a mortality rate of 19.2 for diphtheria and 15.8 for whooping cough.

Any comment on such data would be a reiteration. I hold that the combined diphtheria toxoid-pertussis vaccine used in this experiment produces a very good immunity against diphtheria and confers quite as good protection against whooping cough.

TABLE V

MEAN MORBIDITY AND MORTALITY RATES FROM DIPHTHERIA AND WHOOPING COUGH, PER 100,000 SPECIFIED POPULATION, COMPARING THE PROTECTED AND THE NON-PROTECTED CHILDREN, IN THE EXPERIMENTAL GROUP ONLY, 1943-1945

Cases and deaths are average numbers for the three years	Experimental Group of Children			
	Protected		Non-Protected	
Number of children 0-9 years of age	38,188		145,494	
Disease	Whooping Cough	Diphtheria	Whooping Cough	Diphtheria
(Mean)				
Number of cases	21.3	0.7	2,291	198
Morbidity rates	55.8	1.8	1,574.6	136.0
Number of deaths	0.0	0.0	23	28
Mortality rates	0.0	0.0	15.8	19.2

SUMMARY

1. Some authors condemn whooping-cough vaccination, others support its use enthusiastically: an experiment was undertaken in a large population to prove biologically the value of one particular vaccine.

2. Two cc. were injected in the same arm of children, six months to nine years of age, in three doses at a monthly interval.

3. Twenty-five per cent of subjects showed local reactions, some 10 per cent a general one; a small percentage developed "coqueluchette".

4. During the three years of the experiment, 38,188 children received complete inoculations against diphtheria and whooping cough simultaneously by the combined vaccine-toxoid; 3,086 of them received one year after vaccination a "recall" dose of one cc. and not a single case developed in these children.

5. We received wonderful co-operation from the experimental population.

6. Out of the total number of children vaccinated, 29.6 per cent were under one year of age and 53.4 per cent under three years of age.

7. Six epidemics of whooping cough occurred in the Province from 1926 to 1945 inclusive; the mortality in epidemic and non-epidemic years decreased considerably; the interval between epidemics is from 3 to 5 years.

8. The morbidity from whooping cough, during the experimental years, was twice as high and the mortality twice as low in the experimental group as in the balance of the population of the Province.

9. Over the three years of the experiment, and in the experimental group only, the morbidity from diphtheria in the protected children was 1.8 against 136.0 in the non-protected; and from whooping cough, 55.8 in the protected against 1,574.6 in the non-protected group. In the protected children there was not a single death from either of the diseases; in the non-protected children the mortality from diphtheria was 19.2 and from whooping cough 15.8.

In conclusion, the combined vaccination does not decrease the protection offered to children against diphtheria by fluid toxoid and it gives a very good protection against whooping cough. A recall dose should be given one year after the first three doses and a second one in the pre-school year. I feel justified in extending to the whole population of the Province of Quebec this combined vaccination against diphtheria and whooping cough as a public health measure, commencing on June 1, 1946.

ACKNOWLEDGMENT

The author is greatly indebted to the Directors of the School of Hygiene of the University of Toronto for their help in planning this experiment and to the Directors of Local Health Organizations in the experimental group for their generous co-operation in the experiment and in the collection of information on which this communication is based. To these men goes the credit for the success of the work done.

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FUTURE GOALS IN PUBLIC HEALTH NURSING

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IT is encouraging to know that the Canadian Public Health Association has deep concern for the future of public health nursing. Your concern is indicated by the prominent place you have given to the subject on your program.

Because my job over the last ten years has brought me in direct contact with public health nursing services in both Canada and the United States, I am aware that, basically, we speak the same public health nursing language, whether it be French or English; whether it is spoken north or south of our border. Therefore, with your permission, I shall talk about public health nursing in terms of our own hemisphere. Our principles, our standards, our goals are much the same but, of course, we recognize that the methods of applying them vary to fit the needs of different communities.

Why do we have concern for the future goals of public health nursing? One reason is because of the rapid growth of the public health nursing movement since its inception by the Women's Branch of the New York City Mission in 1877 and by the Victorian Order of Nurses in 1897. It has become a movement of social and group significance and has often been referred to as the unique contribution of the 20th century to public health. Dr. Joseph W. Mountin of the U.S. Public Health Service states, "Today nurses are the most numerous of any professional group in health department staffs — they occupy slightly more than half the classified technical positions" (1).

At this time, there are some 20,000 public health nurses, exclusive of industrial nurses, in the United States and 1,885 in Canada (2). As public health nurses are part of the total nursing profession and as, increasingly, all nurses are being taught the social and health aspects of nursing in their basic courses, it is pertinent to refer to a recent statement about the "Outlook for Women as Professional Nurses" from the Women's Bureau of the U.S. Department of Labor (3). "Nursing has no near rivals as the largest single occupation in the health and medical services. More than a third of the million or so Americans supplying such services in 1940 were nurses." (369,000 trained and student nurses.) "Among women, the predominance of this occupation is even more marked; considerably more than half (59 per cent) of all women employed in health and medical occupations are professionally trained or student nurses.

"In the total occupational line-ups, nursing retains its prominence, ranking second among all professions and thirtieth among occupations of all types, as reported in the United States Census. Nurses have a group significance, therefore, not only as a major resource in the health of the Nation but also as one of the largest single occupational groups in its economic life."

Presented at the thirty-fourth annual meeting of the Canadian Public Health Association, held in the Royal York Hotel, Toronto, May 6-8, 1946, in conjunction with the annual meeting of the Ontario Health Officers Association.

The corresponding figures for Canada are 33,348 graduate and 12,282 student nurses, together making 45,630 (4).

Two things are impressive in these figures and statements, the size of the total number in the nursing profession and the high proportion of public health nurses in relation to other technical workers in health departments. As Dr. Mountin says (1), "Nurses would not be as numerous as they are in public health work had they not been found essential."

But we know that in the United States we need two or possibly three times as many public health nurses as we now have to serve our total population of 140 million people. In Canada you estimate the need for 1,500 more public health nurses and 5,000 more according to the proposed health insurance plans (2).

So our first concern is about growth and development. Growth in terms of numbers, yes, but also development in terms of fitting into the changing order we see all around us. On the beautiful Archives Building in Washington is carved in marble, "The Past is Prologue to the Future." We can not rest on any past in public health nursing. Nor is the present enough. Rather, must we scrutinize our past and present with objectivity and critical analysis in order to anticipate the future goals in public health nursing.

The scope of this paper permits the painting of our past in only a few bold strokes. Florence Nightingale first had the concept of "health nursing". Perhaps that is what we should return to today. It is interesting to note that both the United States and Canada established their first schools of nursing about the same time, in 1873 at Bellevue Hospital in New York City (4) and in 1874 at the General and Marine Hospital at St. Catharines, Ontario, later known as the Mack Training School (4a). Public health nursing, in the United States, began in 1877, as a visiting nurse service for the sick poor, and was promoted originally by private agencies. Twenty years later, in 1897, the first organized public health nursing was done in Canada by the Victorian Order of Nurses. Other interesting "firsts" in the development of public health nursing in our two countries are as follows:

	In the United States	*In Canada*
Industrial Nursing	1895—By the Proctor Marble Company, Proctor, Vermont	1919—By the International Harvester Company
Municipal Public Health Nursing	1898—By the Los Angeles City Health Department	1916—By the Manitoba Health Department
School Nursing	1902—By the Public Schools of New York City	1907—By the Schools of Hamilton, Ontario
Insurance Nursing on a contract basis	1909—By the Metropolitan Life Insurance Company	1911—By the Metropolitan Life Insurance Company
Red Cross Nursing Service	1912—"Town and Country Nursing Service" especially in rural and small town areas.	1921—Generalized programs in several Provinces.
National Associations	1912—The National Organization for Public Health Nursing was formed to bring all component parts together.	1920—A standing committee of the Canadian National Association of Trained Nurses was formed— 1925—This became the Public Health Nursing Section of the Canadian Nurses Association

It is well to pause here to note that in 1912 when the National Organization for Public Health Nursing was formed, Miss Lillian Wald, its first president, suggested the term "Public Health Nursing", which was then adopted. Her idea included Miss Nightingale's concept of "Health Nursing", but by adding the word "Public", she felt it would be understood that such nursing was for all of the public. It should be pointed out that there is confusion over this term. Some think it refers only to nurses employed by public health departments, whereas it includes also nurses employed by schools, industries, voluntary health agencies, and insurance companies.

Shortly after the formation of the National Organization for Public Health Nursing, a new development began in the United States in the provision of Public Health Nursing Consultant Services by State Agencies. In 1913, the New York State Health Department led off by providing the first State public-health nursing consultant service, a pattern now followed by every State. Since 1943, five Provincial Health Departments in Canada also give such service, chiefly in such specialities as industrial, tuberculosis, and venereal disease programs. In addition, the Victorian Order of Nurses employ five national office supervisors to visit its branches.

The development of nurse consultant service on the part of the Federal Government began during World War I, when the U.S. Public Health Service employed a supervisory nurse as well as staff nurses for its program of extra-cantonment sanitation to protect the health of military forces in civilian territory (5).

In 1921, the U.S. Children's Bureau also provided nurse consultants to assist in carrying out the program for the promotion of the welfare and hygiene of maternity and infancy as provided in the "Sheppard-Towner Act" (5a).

However, both of these services were discontinued by the time of the depression. They were re-established in 1934 as a preliminary to the passage of the Social Security Act of 1935. Today, these agencies maintain administrative nursing staffs and cover the country geographically through regional nursing consultants, the total number being 27 (5b).

The Canadian Department of National Health and Welfare now employs three public health nurse consultants for special work in industrial, maternal and child health, and welfare fields.

These national or federal nurse consultants form an important link in the chain as they work through State or Provincial health departments which in turn advise local communities.

This, then, is where we stand to-day. Our purpose has changed from the original limited idea of bedside nursing of the sick poor. The ends sought now by public health nursing are the restoration of the sick, the alleviation of suffering, disease prevention, and optimal health for all the population. Such aims are those of the broad medical and public health program of which public health nursing is but a part.

The public health nurse makes her unique contribution through her personal service, which includes both nursing and teaching. She gives this service by making visits to families in their own homes for part-time care and instruction. The National Organization for Public Health Nursing reports that, exclusive of travel time, health department nurses spend 35 per cent of their time in homes as compared with 50 per cent of the time so spent by staffs of visiting nurse associations (6). The public health nurse also works in health centres, clinics, schools, and industrial plants and may be employed by a governmental or voluntary health or non-health agency.

Her services are no longer limited to the poor, but are available to all irrespective of age or economic or social level. Payment for nursing care is usually on the basis of a fee approximating the cost per visit for those able to pay in full or in part, with free service to those unable to pay. Some insurance companies, governmental agencies, and prepayment medical-care schemes contract for

service at a cost-per-visit rate with public health nursing agencies. The educational visits not associated with nursing care are generally made without charge to the patient since the cost is borne by the community (7).

This is a very sketchy review of our past and our present as a basis for considering future goals in public health nursing. Ahead of us, we see three movements with which public health nursing must be concerned. They may consolidate or divide us, depending on our skill as social engineers. One is the expansion of hospital and public health facilities with growing interest in the hospital as a health centre. The second is the development of prepayment medical-care schemes, whether governmental or voluntary, and supported either by tax or private funds. The third is greater co-ordination between hospitals and health agencies to assure continuity of service to the patient before, during, and after hospitalization.

In a sense, public health nursing is at the very centre of these movements, for public health nursing service will be needed increasingly in all these directions. Our big question is, how best can we serve two publics, those who are under the care of hospitals and public health services, and those who are the individual patients of practising physicians? These publics, of course, overlap, but they are sufficiently distinct in their needs and in the sources from which their direction comes, to make this question the focal point of this paper. To answer this question, it seems to me we must consider four goals: agree as to the patterns of the local organization of public health nursing service; extend these patterns to communities which do not now have any public health nursing service; procure the kinds and numbers of nurses needed, provide for their proper preparation, and develop adequate personnel policies; and promote community planning, interpretation, and support at local, Provincial or State, and national levels.

To begin with local organization of public health nursing service, I think we would all agree that in democratic countries, no one pattern will fill the bill, and that each community must decide for itself which pattern it needs (8). A general review of the management and financing of local public health nursing services, made by the National Organization for Public Health Nursing, reveals that essentially there are three typical patterns:

(1) All public health nursing service, including part-time care of the sick at home, administered and supported by the health department (9).

(2) Preventive services carried by the health department with bedside nursing and some special fields covered by one or more voluntary agencies (10).

(3) A combination service jointly administered and financed by representatives of official and voluntary agencies and all field service rendered by a single group of public health nurses (11).

Communities with both a health department and one or more voluntary agencies far outnumber the others. In large communities, this type of organization may be both economical and sound. In smaller cities, however, an objective analysis no doubt would prove that a better community service can be given for each dollar expended through a combination.

In all of these patterns, consideration must be given to the best method of

including both school and industrial nursing. But no matter what the pattern of organization, the following principles are essential:

(1) The health officer should be recognized as the official health leader of the community. Public health nursing, when not directly under the administration of the health department, must be closely co-ordinated with the health department so that there may be an inclusive plan which meets the total needs in that community.

(2) It is important to have a well-informed representative citizens' committee to promote and support a comprehensive health program and to assure the selection of well-qualified health leaders. The citizens who know intimately the situation in their communities, and who pay the bill, should be active participants in planning a public health nursing service for their community.

(3) In general, both public and private funds are needed to provide a complete service, and financial arrangements should be such as to make possible the purchasing of service by individuals or contracting agencies.

The usual sources of income now available for public health nursing include:

a. Local, State or Provincial, and Federal tax appropriations, including those for boards of education.

b. Contributions from individuals, community chests, and other agencies.

c. Contracts with industries and insurance companies.

d. Fees from individuals to whom service has been rendered.

e. Income from endowments.

Consideration should be given to the possibility of pooling all of these needed sources of financial support.

This will show you that there are more than two horns to our dilemma. There is no question that the best arrangement, from the standpoint of the family, is to have only one nurse visit the home. This nurse would give needed nursing care under the direction of the family physician, be familiar with all the health needs of various members of the family, and interpret to the family, the appropriate health messages and programs of the various health agencies of the community. She would, in turn, report back to the practising physician, the health department, the school, and the employer.

This is actually what is happening in some rural and a few urban areas today. But at the same time, there is need for nursing service in clinics, schools, and industries; and for group activities. So it is a real question whether the one nurse who visits the family can also serve so many masters.

On the other hand, the most common pattern is the maintenance of at least two services in a community, one under the health department which may or may not include school nursing, and the other a service under a voluntary agency like the Victorian Order of Nurses, or visiting-nurse associations in the United States. Even in such situations, it must be remembered that the larger industries employ their own nurses, although the nurses make few home visits, and that where school nursing is not a function of the health department, it is provided by the board of education.

Because of the need of the Metropolitan Visiting Nurse Service for covering rural areas and utilizing certain urban health departments, our Nursing Advisory Committee of which Miss Elizabeth Smellie is a member, made a proposal several years ago to establish the principle that nursing care of the sick is a legitimate function of nurses employed by health departments. Miss Pearl McIver of U.S. Public Health Service, another member of our Advisory Committee, was instru-

mental in having a resolution to this effect adopted at the Conference of State and Territorial Health Officers, March 26, 1942 (12). But resolutions are just resolutions unless they are implemented.

We now have 40 Metropolitan nursing affiliations with health departments which present such varying degrees of problems that we set up the following "Suggestions to Health Departments for Giving Bedside Nursing Care in Affiliation with the Metropolitan Life Insurance Company":

It is assumed (1) that only health departments under the direction of well-qualified health officers are ready to take on the responsibility of a bedside care program; (2) the health officer accepts bedside nursing as an important part of the health department service and gives it his full support. Also, it is suggested that such health departments maintain the conditions outlined below:

(1) The selection and operation of the staff on a merit and professional basis, as recommended by the Children's Bureau and the United States Public Health Service. These recommendations are in acordance with National Organization for Public Health Nursing standards and State Board of Nurse Examiners' regulations.

(2) The Nursing Staff consists of:

a. A nurse director who understands bedside nursing service and accepts it as an important part of health department service.

b. A nursing staff in which the majority understand bedside nursing, and those lacking experience are willing to learn. The selection of new staff members is made from nurses with experience in bedside nursing.

c. One supervisor with previous experience in visiting nurse work and with special responsibility for the bedside nursing program, where a staff of more than 10 nurses, including students, is involved.

(3) A staff education program is maintained which provides for:

a. Refresher work for one or two months in a hospital nursing service or a visiting nurse organization for staff nurses who may have lost their skills.

b. Special emphasis on bedside nursing (including demonstrations) for all of the staff in their regular staff education program.

c. The introduction of new nurses to the bedside nursing program as well as to the health department activities.

d. A special program in relation to health department activities if the staff of the visiting nurse association is to be taken over by the health department.

(4) Some method is in operation for maintaining the interest of lay groups for the interpretation of community needs to the nursing service and for the interpretation of the nursing service to the community.

Where a health department has an over-all advisory committee to the health department, there may be a sub-committee on nursing. Where there is no over-all advisory committee, a separate nursing advisory committee is suggested.

It is suggested also that a medical advisory committee be formed to approve standing orders, advise on the nursing program, and interpret the nursing service to the medical profession.

(5) A legally established policy is maintained for the collection of fees from those who can pay part or all of the charge for service, for making contracts with insurance companies, etc.; these fees to revert to the nursing budget and to be made available for necessary expansions of the nursing service. It is understood that service would be provided to those who cannot pay all or part of the cost.

(6) A sufficient number of nurses are employed to make it possible to give the kind and amount of nursing service needed to everyone in the community regardless of economic status, race, creed, color, or national origin. The proposed goal is one nurse to 2,500 of the population.

(7) A well-defined program of public information is carried on so that all of the community will know how and when to use the service.

Obviously, in rural communities a single agency, and that the health department, is the only answer. I sincerely hope, however, that such health departments will have enough nurses to provide not only an emergency and demonstration nursing care program, but that they will approximate the kind of needed care given by the Victorian Order of Nurses.

In many medium-sized communities, a combination of all services under one agency may be the answer. Some cities may be ready for such a combination and effect it easily. Others will need to give careful consideration to the many preliminary steps recently outlined by the National Organization for Public Health Nursing (13). In the large cities, there is greater difficulty in making a combination although some welcomed experiments are under way.

In Canada you have a great advantage over us in the United States, for your visiting nurse service is centralized in the Victorian Order of Nurses and decentralized through its 103 branches. Thus you have an organization with high standards of service through which governmental agencies, insurance companies, and prepayment medical care plans can readily make contracts for service on a nation-wide basis. There is no corollary in the United States because our visiting nurse services are local, independent units related to our National Organization for Public Health Nursing for advisory and consultative, but not administrative, service.

If there are two agencies in a community—and competition is said to be the life of trade—each may assist the other in reaching better standards of operation. A clear-cut definition of functions can be established and joint staff meetings arranged so that the right hand knows what the left hand does. Many communities have proved that both hands can work in unison. Patterns of organization are so important that perhaps far too little time has been left in this paper for the other goals we are discussing.

The second goal is the extension of public health nursing to communities which do not have it. Here is a clear field in which to apply the best principles for effective organization, to avoid the mistakes of duplication and overlapping in communities with too many services, and to plan such expansion in keeping with the total public health program on the basis of local health service suggested in the American Public Health Association report, "Local Health Units" (14).

Public health nursing should be available country-wide in both rural and urban communities. In the United States about one-third of our counties are lacking it. To accomplish proper distribution, all of our national and Federal agencies are needed to give the necessary push and to stimulate State and Provincial services, and local communities to play their part.

Our third goal is procurement of the kinds and numbers of nurses needed, making provision for their proper preparation, and formulating adequate personnel policies. Extension into new areas means increased number of nurses. Also, the fitting of public health nursing into expanding public health programs, prepayment medical care plans, and the anticipated greater co-ordination between hospitals and health agencies will require not only more, but better prepared, public health nurses.

Even in communities already having a public health nursing service, only 11 per cent of the total cases of sickness had nursing care, according to a study made

by Miss Jean Downes (15). Dr. Louis I. Dublin estimates, on the basis of Miss Downes' findings, that "With a program of good public relations bringing this service home to the people and the medical profession, there will be no difficulty whatever in absorbing twice as many public health nurses as we now have for the care of the sick alone" (16).

The greatest difficulty is to find the nurses. Where are they? At no time before, during, or since the war have there been such shortages as today. And in the United States the recruitment of new students into schools of nursing is meeting with untold obstacles. This seems to be a universal problem. I noted in a recent newspaper article that the shortage of nurses in England was so acute that foreign nurses are being recruited.

Recently, I heard a hospital administrator describe the expansions planned in his institution. A nurse said to him, "Where are you going to get the additional nurses needed? Wouldn't it be a good idea to consider this before expanding?" The administrator came to with a start. He had never thought of that.

We, in the United States, are in a terrific lull right now between the tremendous nurse recruitment war efforts, aided by Federal funds, and the voluntary efforts with much skimpier funds to be anticipated. Bold leadership is needed by the nursing profession and strong support and active participation by hospital, health and lay leaders if the supply of nurses is to meet all the demands of the expanding postwar program.

These demands are not only for numbers of nurses but for the kinds of nurses who can perform adequately in an ever-broadening field. What this field is can be judged to some extent by reading the lively controversy between Dr. Joseph W. Mountin and Miss Elizabeth G. Fox in recent numbers of "Public Health Nursing " (1, 17).

In regard to the preparation of the public health nurse, there are three points I should like to emphasize. The first is that we need to have a rebirth of belief among nurses that nursing care is the highest service that any professional woman can perform. Too many nurses, from students up, are all too eager to get away from actual nursing care. Yet no future generalized program in public health nursing can succeed unless there is a combination of nursing and teaching. Certainly, in the future, people who pay premiums for health insurance will expect real service in terms of nursing as well as advice and guidance. Practical nurses and visiting housekeepers will have their place, but only a very practical kind of public health nurse will be in a position to supervise them.

The second point about preparation is a pertinent question raised by Dr. N. L. Burnette, Assistant Vice-President, in charge of the Health and Welfare Division of the Canadian Head Office of the Metropolitan Life Insurance Company. Dr. Burnette asks, "Is enough time spent in public health nursing courses on the art of teaching, and is any thought given to the fact that a group of nurses taking a public health course may all have the same technical background but as individuals may vary greatly in their ability to teach?" In general, I believe attention is being given to this problem of variation, but you may want to discuss it with your nurse educators and in your own staff educational conferences.

The third point about preparation is that I believe we should eventually so expand the curriculum of the basic course in schools of nursing that all graduates will qualify for first-level positions in public health nursing. Then, possibly, after one year of externship in a local public health agency, the nurse may qualify for an advanced position by taking a year of postgraduate study. For the present, however, we must continue to give postgraduate preparation in order to qualify nurses fully for public health nursing. Of our 1,300 schools of nursing in the United States, three university schools,—Skidmore, Vanderbilt, and Yale —now integrate public health nursing so completely in the basic curriculum that their graduates meet the full requirements of the National Organization for Public Health Nursing for staff-level positions in public health nursing. We think this is a most significant start in the right direction. Of course, there is need in all public health nursing services for in-service training to introduce new workers and to keep all workers abreast of current developments.

Of personnel policies, all I can say is that one of the greatest travesties in the face of the health needs of our people is the lack of adequate provision for pay, sick leave, retirement, vacations, etc., for nurses. We forget that the workers must be healthy and happy to do their work. We will never recruit the kinds and numbers of nurses needed until our personnel policies keep pace with our over-all objectives.

Community planning, interpretation, and support at local, Provincial or State, and national levels is our fourth goal. It can readily be seen from the foregoing that public health nursing, as well as the whole nursing profession, needs the help of many groups in the community. It cannot play the game alone.

To make it possible for all interested to play their part, we recommend the formation of local community nursing councils. Such councils should represent the various nursing interests, such as hospital nursing, private duty nursing, public health nursing, etc. They also should provide opportunity for participation by public health officers, practising physicians, hospital administrators, educators, and social workers. In addition, they should include lay men and women who know the health needs of their communities and the part nursing has to play in meeting them. In other words, they represent the recipients of the service. A nursing council can function best as part of a public health council or of the health division of a council of social agencies.

Doubtless you are aware of the great stimulus given to joint planning by the recommendations of the Gunn-Platt report (18). While in hearty agreement with its general conclusions, the Board of Directors of the National Organization for Public Health Nursing at its meeting on January 25, 1946, took the following action regarding one of its recommendations:

"Since the Gunn-Platt report, *Voluntary Health Agencies*, advises that all voluntary health agencies except hospitals and clinics be unified under one administration, and since visiting nurse associations unlike most of the voluntary health agencies are direct service agencies, it is voted that the National Organization for Public Health Nursing go on record as recommending that visiting nurse associations as well as hospitals and clinics be excluded from the proposed unification of all voluntary health agencies into one organization in order that visiting nurse associations may more easily establish direct co-operative relationships with official

agencies providing nursing service as well as maintaining active co-operation and carefully co-ordinating their work with that of other voluntary health agencies."

Public health nursing agencies must be free to gear their programs, as needed, with hospitals, with public health departments, and with practising physicians. There is no idea in this resolution of a desire to withdraw co-operation, but rather a recognition of the need for freedom to co-operate in the most practical way.

At the State or Provincial level, we see public health nursing consultant service provided chiefly to local public health departments. Should this service now be broadened, in view of the new interest in medical-care plans, to include consultant service to the voluntary agencies? If so, a new type of consultant will have to be selected who is as conversant with actual nursing care as she is with preventive and instructional service.

At the national level, there is no doubt of the need for closer co-ordination and planning. In the United States the following agencies are concerned with public health nursing on a country-wide basis: National Organization for Public Health Nursing, American Public Health Association, American Red Cross, U.S. Public Health Service, U.S. Children's Bureau, John Hancock Mutual Life Insurance Company, and Metropolitan Life Insurance Company.

This year, for the first time, medical and nursing representatives of these groups have, under the aegis of the National Organization for Public Health Nursing, organized a joint committee to consider a comprehensive program for public health nursing and the part that each can play in implementing it. We may never all speak exactly the same language but at least we can agree on certain fundamentals and then promote them according to our various spheres of influence. Also, together, we can get an over-all view of the total needs and total resources that should result in maximum co-ordination of effort and a minimum of duplication and overlapping.

In summary then, we have one over-all goal, to get public health nursing, including nursing care, to all the individuals and families who need it, no matter where they live, whatever race, creed, color, or national origin, whether rich or poor.

Finally, I wish to repeat that public health nursing in our hemisphere has matured into a recognized essential service in the field of public health. It is a complex service centring first of all about the needs of individuals and families. In filling their needs, public health nursing must fit into the services of family, physicians, health departments, schools, industries, and community patterns. It must also be appropriately interwoven into the fields of such related co-workers as social workers, physical therapists, occupational therapists, nutritionists, and health educators. It must utilize the services of practical nurses and visiting housekeepers. We recognize that there is a place for all of these workers in public health programs and we need their full co-operation and support.

We also recognize the importance of citizen understanding, first, that the people may know how and when to use the service; second, that through the membership of citizens on boards and committees and through volunteer services, they may provide the necessary interpretation and financial support needed for present and future programs.

Furthermore, we realize that we are in a changing order with at least three mass movements, which I mentioned before, influencing our development. Yes, as Miss Fox says, "it's an exciting future" (17).

Of one thing I am certain, the times call for an increased number of public health nursing services, better distributed, and of a higher caliber. We are at an important crossroad. But—we need the best brains in the profession of public health, as represented by the Canadian Public Health Association, to help us plan wisely for the future developments of public health nursing. It is only with your help that we can go forward to do our part in providing the service, instruction, and kindliness of the public health nurse to all of our people.

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NUTRITION PROBLEMS OF PRE-SCHOOL CHILDREN

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IN 1943 members of the nutrition staff of the School of Hygiene were asked to assist in the Wartime Day Nursery program in Ontario by assuming responsibility for nutritional conditions in the nurseries. Since that time, menu planning for the nurseries and supervision of food preparation have been done by a committee (Dr. Leeson, Mrs. Crawford and Dr. McHenry) from the School of Hygiene, assisted very materially by Mrs. Taylor of the Institute of Child Study. The problems encountered with these children are essentially the same as those that occur among children living at home. For that reason, procedures which have been found advantageous in the nurseries may be very useful in homes.

I. General Arrangement of Food Supplies

In planning the nursery nutrition program, it was necessary to consider first the nutritive requirements of the children. The recommended amounts of nutrients for children between 2 and 5 years of age are given in Table I. The foods that were considered to supply these nutrients are listed in Table II.

Table I

Nutritional Requirements of Pre-school Children

(N.R.C. Recommended Dietary Allowances, 1945)

	2 years	5 years
Calories	1,200	1,600
Protein	40 grams	50 grams
Calcium	1.0 gram	1.0 gram
Iron	7 mg.	8 mg.
Vitamin A	2,000 units	2,500 units
Thiamin (B_1)	0.6 mg.	0.8 mg.
Ascorbic acid (C)	35 mg.	50 mg.
Riboflavin (B_2)	0.9 mg.	1.2 mg.
Vitamin D	400 units	400 units

The nursery children are given breakfast at home, usually quite early, and brought to the nursery about 8-9 o'clock. They remain there until about 6 p.m. and are given supper at the nursery. In all probability the food received at home could not be counted on to provide any large proportion of the essential nutrients; it was therefore decided to provide, as nearly as possible, the total day's require-

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ment in the nursery meals. Since the children vary greatly in the amount they eat, their actual intake could only be estimated roughly. However, by utilizing the so-called "protective" foods almost exclusively in planning the menus, the children are likely to receive optimal amounts of the essential nutrients, with the exception of those provided by one food. This food was milk; it was not possible for them to take the recommended quantities of milk while they were at the nursery and still have an appetite for other foods. Milk, however, was the only highly nutritive food that all the children received fairly consistently at home,

Table II

To obtain requirements of some nutrients certain foods are necessary or advisable

Calcium Riboflavin	—	1½ pints milk
Vitamin D	—	2 tsp. cod liver oil
Iron	—	1 serving lean meat 4 eggs per week 2 servings vegetables
Thiamin	—	whole wheat bread whole grain cereal
Ascorbic acid	—	citrus fruit or tomato juice

Table III

A Typical Day's Menu in the Wartime Day Nurseries

Mid-morning	—	1 glass milk 1 sunwheat biscuit
Noon	—	roast beef mashed potato green beans carrot sticks lemon snow with custard sauce whole wheat bread, buttered 1 teaspoon cod liver oil
Mid-afternoon	—	1 glass tomato juice
Supper	—	cream of spinach soup peanut butter sandwiches lettuce wedges fruit cup milk 1 teaspoon cod liver oil

morning and night. Our policy has been to concentrate on encouraging the children to eat a balanced diet, with emphasis on meat, fruit and vegetables, instead of on milk, to the exclusion of these others.

The meals provided at the nursery are a noon dinner and supper. In addition, a drink of milk is given about 9 a.m. and a glass of fruit juice in mid-afternoon. Table III shows the menu for a typical day.

II. Cooking Methods

In supervising the nurseries, considerable emphasis has been placed on proper cooking of the food. This is important from two viewpoints: first, the

preservation of nutritive value; secondly, in the transition from infant's food to a more or less adult type of diet, the children must learn to accept many new foods, so it is most important that they should be attractively presented and should taste good.

Vegetables are not prepared for cooking until just before it is time to cook them. They are cooked in as little water as possible for as short a time as possible, and then served immediately. In this way, vitamin losses are kept to a minimum. Vegetables are served raw once or twice a day, and raw fruit is frequently used.

Meat is either broiled, roasted or stewed. Because the younger children cannot chew it properly, the meat is always minced before it is served. Fried food, of course, is never served, and pork and veal are excluded from the nursery menus. Fish is usually finely divided and cooked in milk in the oven. Seasoning and sweetening are kept to a minimum in all the food served.

III. Service of Food

A modified form of cafeteria service has been found to be most satisfactory in day nurseries; this procedure was developed by the staff of the Institute of Child Study. The children go to the serving table to get their plates and carry them back to their places. If they want more than one helping, they carry their plates back for refilling. After the main course, they take the used plates back and are given a teaspoon of cod liver oil, then take their dessert to their own table. Small servings are given, so that it is not uncommon for a child to have four or five helpings of the main course, and three or four portions of dessert. This is a definite matter of policy. A second helping is not given until all of the first helping is eaten; if this includes some food that the child does not like, he will usually manage to eat it if only a small amount is given, whereas a large helping discourages him before he ever tries it. The opportunity to walk back and forth for refills gives him a welcome relief from sitting still, and thus serves as a subtle incentive to appetite.

IV. Feeding Problems

What are the main problems of feeding pre-school children? The first, both in time and in magnitude, is the decrease in appetite that normally occurs between the ages of 1 and 2 years. It is extremely common for a 1-year-old to eat what seem to be prodigious quantities, and a year later to eat much less, and to seem completely indifferent to food. This is a problem only because we make it so. The mother has never been warned that this normally occurs, becomes seriously alarmed, and tries to coax or scold the child into eating more food than he wants. He reacts to this behaviour either by coming to hate mealtimes, or by discovering that refusing to eat is his best way to attract attention. Thus, by unwise handling, a perfectly normal 2-year-old is converted into an actual feeding problem by the age of three. The situation need not arise at all if the person in charge of the child's meals realizes that the 2-year-old's behaviour is completely normal, and does not urge him to eat beyond his appetite.

In the nurseries, the supervisors manifest no emotion about a child who does not eat much. The child is never aware that his failure to eat is getting him any attention, and so the main incentive to refusing to eat is removed. The results of this treatment are dramatic — living a healthy, regulated life, the child becomes hungry for meals, and finding that being a problem evokes no interest, he quickly settles down to eating normally. At home, if a child does not eat his meal, his mother frequently gives him small snacks to tide him over to the next mealtime. In the nurseries, food is given only at the stated times and the child knows how long he must wait for his next meal.

The second great problem in this age group is the acceptance of unfamiliar foods. Mothers often make the mistake of expecting a child to eat a normal-sized helping of a new food the first time he tastes it. This he will practically never do, and he leaves the tearful session firmly determined that that food shall never again cross his lips. In the nurseries, great care is taken to introduce the new food in very small amounts, and associated with other foods that are well-liked. Once a new food has been introduced, it is repeated often enough that it does not become completely unfamiliar in the interval. In this way, children can be taught first to accept, and later to like, almost any food. We have introduced various rather uncommon foods into the menus — such things as sweet potatoes, egg-plant, squash — in the belief that the more types of food a child knows and likes, the more assured he is of getting a well-balanced dietary in later life.

A frequent cause of poor appetite in young children is fatigue. In trying to fit the child's meals into the adult household, the mother frequently gives him a light lunch, with his main meal at night. Unfortunately, by night the child is often too tired to eat much. Once the "edge" is taken off his appetite, he succumbs to sleepiness. The mid-day dinner is much more satisfactory for young children. In the nurseries, the children are always given a non-active interval, such as listening to a story, or singing, and then a ten-minute rest before the meal. This gives them time to calm down from boisterous outdoor play, and to go to the meal relaxed and rested. Such a rest-period preceding the meal could profitably be introduced into the home.

Many of the procedures that have proved valuable in nurseries do not seem at first glance applicable to home-life. Certainly, "mass psychology" is a powerful force in the nursery that is hard to introduce into the home. However, a child at home is more apt to accept all sorts of foods readily if his parents are eating the same food, and not loudly discussing their food dislikes in front of him. It is amazing how children emulate their elders in the matter of dislikes. But many of the nursery procedures can, with a little care, be transferred to the home environment. First of all, the type of menu — with heavy emphasis on meat, fruits, vegetables and whole-grain cereals, and with no sweets or pastries. Secondly, the lack of emotional approach to meals. Then all the other little procedures — giving the child a valid reason for moving around a bit during the meal, giving small helpings to encourage appetite and help in learning to take new foods, having a rest before the meal.

We have so far not encountered a single child who could not learn to take cod liver oil as readily as he would take bread. One little boy was highly indignant because he was not allowed another helping of cod liver oil each time he went back for another dessert!

The opportunity to apply modern nutritional knowledge to the feeding of children in nurseries has shown that immediate benefits can be secured. Procedures developed in nurseries for the prevention of feeding problems can be applied usefully in homes.

THE EFFICIENCY OF THE RED CELL ADSORPTION AND ELUTION METHOD FOR THE PREPARATION OF INFLUENZA VACCINE

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IN 1943 Francis and Salk described a method for the preparation of concentrated influenza vaccine involving adsorption of the virus on fowl red cells and its subsequent elution into saline.

Living fertile eggs, inoculated 48 hours previously with influenza virus, are opened above the air sac; and the chorioallantoic membrane, along wtih any large vessels lying below, is torn to allow blood to escape into the allantoic fluid. The mixture of allantoic fluid and blood is aspirated into a bottle and kept overnight at 0°C. to 4°C. During this phase, the virus is adsorbed by the red cells, which sink to the bottom as a firm agglutinated mass. The supernatant fluid is then removed and replaced by physiological saline equal in volume to one-tenth that of the total harvest. The mixture of red cells and saline is incubated at 37°C. for 2½ hours, at which temperature elution of the virus from the red cells into the saline occurs. The cells are separated by centrifugation and the supernatant, which constitutes the raw vaccine, is removed.

The present paper is a discussion of the efficiency of the method.

Methods

Preparation of Seed

The PR8 seed used throughout was received originally from Dr. Frank Horsfall in 1940 as PR8 F198, but has since been adapted to eggs and is now known as PR8 F198 M8 E8, denoting that it has received 8 mouse- and 8 egg-passages in these laboratories.

For a short time a strain of Lee virus received from Dr. Thomas Francis Jr. in November 1940 and adapted to eggs in these laboratories was employed, but in October 1944, a new strain, Lee 137.51 11/2/44, was obtained from Dr. Francis and used to make a stock of seed known as Lee 137.51 E1.

The mother seed was kept in the form of infected allantoic fluid, dispersed in 2 cc. quantities in the CO_2 ice box at—70°C. When seed was required, a fresh bottle of mother seed was melted and diluted 1/100 in 10 per cent horse serum saline, and 0.05 cc. was inoculated into the allantoic space of 12-day eggs. After incubation for 48 hours at 37°C. for PR8 virus and 35°C. for Lee virus, the allantoic fluids were removed aseptically and tested for sterility. The sterile fluids were dispensed in approximately 2 cc. amounts in 10 cc. stoppered bottles and stored unfrozen at 4°C. Before use the virus was diluted 1/1,000 with 10 per cent horse serum saline. No seed older than 7 days was used.

Inoculation of Eggs

After incubation for 12 days, the eggs (White Leghorn) were candled, the living eggs swabbed with iodine, the shell pierced by a stab above the air sac, and 0.20 cc. of the diluted virus suspension inoculated. The eggs were again swabbed with iodine and the holes sealed with paraffin wax.

Incubation

The inoculated eggs were incubated 48 hours, those containing Lee virus at 35°C. and those containing PR8 at 37°C. Particular care was taken to ensure adequate humidity and aeration in the incubators.

Harvesting

The eggs were candled and only living embryos used. The shell above the air sac was charred with a gas oxygen flame and removed with sterile forceps. The chorioallantoic membrane beneath the air sac was also removed, the underlying vessels torn and the egg rotated to mix the blood and allantoic fluid. The mixture was aspirated into a 4-litre bottle which was kept packed in ice. Care was taken to avoid harvesting amniotic fluid, which contains very little virus.

Adsorption

The bottles of harvested material containing about 2 litres were packed in more ice and kept in the refrigerator at 0°C. to 4°C. overnight. The supernatant fluid was then removed by aspiration from the packed mass of red cells and adsorbed virus.

Elution

Physiological saline equal in volume to 1/10 that of the harvest material in each bottle was added to the cells. The bottles were then incubated in a water bath at 37°C. for 2½ hours. They were gently shaken during the course of incubation. The mixture of cells and saline was then transferred to centrifuge bottles and centrifuged at low speed. The supernatant fluid containing the virus was removed from the packed cells into 250 cc. bottles. Each such bottle contained the final yield from about 2,000 cc. of harvested material. For a time, less saline corresponding to 1/13.3 of that of the harvest was added to the bottles containing Lee (influenza B) virus.

Subsequent Processes

Formalin and merthiolate to give final concentrations of 1/2,000 and 1/20,000 respectively were added and the bottles held at 4°C. After 4 days, sterility tests were carried out and the sterile bottles were subsequently pooled into lots containing approximately equal quantities of PR8 (influenza A) and Lee (influenza B) vaccines. After the necessary tests for red cell titre, toxicity, non-infectivity, antigenic power, and sterility, the vaccine was dispersed into rubber-capped vials and, after further sterility tests, was ready for use.

Agglutination Titration Techniques

For routine titrations on samples from the production line, the doubling dilution method described by Hirst (1942) was used. For more critical experimental work, however, a much more extended series of dilution was employed. The virus was first diluted according to the range required. This preliminary dilution was added to tubes containing amounts of saline varying from 0.00 cc. to 0.96 cc. to bring the final volume in each case up to 1.00 cc. as in the case of the doubling dilution method. This gave a series of dilutions after the addition of cells, ranging from ½ to 1/50 of that of the preliminary dilution.

In all titrations the series of virus dilutions were set up in tubes 8 mm. × 75 mm. held upright in wooden blocks. The red cells were obtained from 200 cc. quantities of blood from the slaughter house. One cubic centimetre of a 2 per cent suspension of these in saline was added to each tube and the series stirred by bubbling air through the tubes with a pipette. The titrations were allowed to stand for 75 minutes at room temperature and the density of the cells left in suspension was compared with that of standards containing 0.5 per cent and 0.75 per cent red cells, a zone 1 cm. high whose midpoint was 1.5 cm. from the bottom of the tube being used for this purpose. The end point was taken as the tube with a density midway between the two standards.

In order to have comparable results in the experimental work, the supernatant, vaccine, pool and any other titrations were done at the same time with the same cells wherever possible.

Experimental Data

In the first experiments, the efficiencies of the adsorption and elution proceedings under small-scale laboratory conditions were investigated separately.

Suspensions of washed, fowl red cells in allantoic fluid were made up in 10 cc. volumes so that the concentration of red cells would vary from 0.12 per cent to 3.0 per cent. The cells were prepared aseptically from samples of pooled, citrated blood of five different chickens. The mixtures were chilled and held at 0°C. for a period of two to sixteen hours. The variation in time of chilling did not appreciably alter the results. The cells with adsorbed virus were thrown by low-

TABLE I

Percentage adsorption of virus with different red cell concentrations

Percentage cell concentration	Percentage adsorption of virus in PR8 fluid	Percentage adsorption of virus in Lee fluid
0.12	41	18
0.25	74	55
0.50	92	76
1.00	96	85
2.00	98	91
3.00	100	92

The figures represent percentages calculated from the reciprocals of the dilution at the end point of each titration. In each instance the calculated figures are the average of six estimations.

speed centrifugation and the supernatants titrated. The amount of virus adsorbed could then be determined by comparison of the pool and supernatant titres. The average of the results obtained for 6 estimations with PR8 and 6 with Lee is given in Table I.

It is obvious that there is definite correlation between the cell concentration and the adsorption of the virus, there being a rapid decrease in the efficiency with cell concentrations below 1 per cent. Above this concentration, a very high proportion of the virus is taken up by the red cells.

In order to investigate the efficiency of the elution phase, an experiment was set up in which sufficient red cells to give a 2 per cent suspension were added to 5 cc. pools of allantoic fluid. Following adsorption at 0°C., the mixtures were incubated at 37°C. for 2½ hours. After low-speed centrifugation, the fluid was removed and titrated. In estimations with 6 different pools of PR8 virus, 95 per cent of the original virus was present in the supernatant after these procedures, and in 6 similar estimations with Lee pools, 89 per cent was present.

The results of these two experiments show that adsorption of the virus from the fluid at 0°C. and elution back into the original fluid at 37°C. are both highly efficient. In the preparation of vaccine, however, the allantoic fluid is removed and the elution takes place into physiological saline. In addition to the change of eluent, its volume is only one-tenth.

TABLE II

PERCENTAGE YIELD WITH ELUTION INTO DIFFERENT AMOUNTS OF SALINE

Saline used for elution (cc.)	Percentage yield of virus			
	PR8 (1)	PR8 (2)	Lee (1)	Lee (2)
15	67	75	67	80
7.5	67	75	67	90
3.0	67	80	80	64
1.5	57	70	67	80
1.0	62	67	73	67
0 75	67	69	83	66

15 cc. amounts of fluid adsorbed with 2 per cent red cells and eluted with varying amounts of saline. Results calculated as in Table I.

To investigate these factors, two experiments were carried out. In the first, red cells were added to 15 cc. amounts of fluid, to give 2 per cent suspensions. After thorough chilling, the tubes were centrifuged and the supernatants removed. Saline varying in amount from 15 cc. to 0.75 cc. was added to each tube and the tubes incubated at 37°C. After the 2½ hours' incubation, during which they were shaken frequently, the tubes were again centrifuged and the supernatants removed and titrated.

Apart from fluctuations probably due to slight errors in technique, the results in Table II are reasonably constant and indicate that, within limits, variation in the volume of the eluting fluid will not affect the yield, although it does of course alter the titre. For this reason, it has been our practice to use

smaller quantities of eluting fluid, giving concentrations of 13.3 times or even 20 times, if the titre of the allantoic fluids from the eggs undergoing processing was low.

In the second experiment, varying quantities of red cells were used for adsorption, with elution into a volume of saline equal to one-tenth that of the allantoic fluid. The results, given in Table III, indicate that at least 0.5 per cent red cells are necessary for an adequate overall yield.

Thus these two experiments show that the efficiency of the adsorption and elution proceedings, using saline as eluent, is not affected by the volume of eluent, but the concentration of red cells does impose differences. At concentrations below 0.5 per cent the adsorption is poor. Higher concentrations than 3.0 per cent were not employed. Provided 0.5 per cent or greater amounts of red cells were present, the efficiency of the process was 70-93 per cent with PR8 virus and 63-80 per cent with Lee virus. Thus under laboratory conditions these procedures are reasonably efficient.

TABLE III

PERCENTAGE YIELD USING DIFFERENT CELL CONCENTRATIONS

Percentage cell concentration	Percentage yield of virus in PR8 fluid	Percentage yield of virus in Lee fluid
0.12	43	35
0.25	63	58
0.50	79	74
1.00	82	76
2.00	83	76
3.00	78	

Elution took place into one-tenth volume of saline. Results calculated as in Table I. Figures represent averages of six estimations for PR8 and four estimations for Lee.

The Efficiency of Large-Scale Production

From September 1944 until March 1945 vaccine was produced on a large scale, using the procedures already described. In contrast to the preceding experiments, which were carried out with pools of known titre, the titre of the harvested fluid was unknown because it was mixed with red cells in the process of collection, and adsorption occurred almost at once. To overcome this difficulty, an attempt was made to determine the titre by sampling the eggs from each batch of 2-3,000 being processed. Sixteen or more eggs were taken from the different shelves in the incubators, and the allantoic fluids, free from cells, were withdrawn. The titres of these fluids, which are given in Table IV, show that there was wide variation in the virus content of the eggs. This was particularly marked with Lee virus. For instance, the fluids of 14 or more eggs apparently had no virus at all while the fluids of others on the same days were of good titre. Much time and trouble were spent in attempts to provide an explantion for these variations in virus content, but without success.

During the early period of production the geometric mean of these individual titres was assumed to represent the titre of the fluid being actually

harvested. The great number of titrations, however, prevented continuation of these individual titrations, and after December 2 equal quantities from the fluids of individual eggs were therefore pooled and titrated as a pool.

It is freely admitted that the geometric mean of the titres of the allantoic fluids from only 10-20 eggs may be very different from the true value obtained when 3,000 or more eggs are harvested. Nevertheless, these are the only estimates obtainable for the original titre and in any case are of the same order of magnitude as experimental pools made with these strains.

In the manufacture of vaccine, each bottle of 2000 cc. of raw harvest was in general treated separately and the vaccine made therefrom (100-200 cc. in amount) was kept separate. For a time samples were taken from these bottles of vaccine before and after inactivation with formalin but since the fall in titre

TABLE IV

TITRES OF FLUIDS OF INDIVIDUAL EGGS HARVESTED EACH DAY

	PR8 Fluids					
DATE	Nov. 9	Nov. 10	Nov. 17	Nov. 18	Nov. 20	Nov. 21
FLUID TITRES	768 × 3 512 × 1 384 × 1 256 × 1	1024 × 3 512 × 6 384 × 1	1024 × 2 768 × 1 512 × 4 384 × 3 256 × 1 >64 × 1	1024 × 2 768 × 1 512 × 3 384 × 1 256 × 1	1024 × 2 512 × 2 384 × 2 256 × 1	1024 × 2 768 × 1 512 × 6 256 × 6
GEOMETRIC MEAN...	524	612	325	583	524	440

	Lee Fluids							
DATE	Nov. 3	Nov. 6	Nov. 7	Nov. 8	Nov. 11	Nov. 13	Nov. 14	Nov. 15
FLUID TITRES	512 × 4 384 × 2 256 × 2 192 × 1	1024 × 3 256 × 3 192 × 2 >64 × 2 32 × 1	512 × 3 384 × 2 256 × 4 128 × 3 >8 × 1	512 × 2 384 × 1 256 × 2 192 × 3 48 × 1 16 × 1 >8 × 1	512 × 4 384 × 1 256 × 2 >32 × 1	512 × 2 256 × 6 192 × 3 64 × 1 48 × 1	512 × 3 384 × 1 256 × 6 192 × 2 128 × 1 >32 × 1	384 × 1 256 × 4 192 × 2 64 × 1 >16 × 2
GEOMETRIC MEAN.	369	107	177	112	191	251	187	82.6

during inactivation was very slight, samples were, in general, taken only after the inactivation procedures. The titre of each bottle was determined, but in some cases pools made from equal amounts from each bottle in the day's run were also titrated.

In the calculation of the overall yield on the basis of red cell agglutination titre, different methods were employed. During November, when the geometric mean of the titres of 10-20 eggs was the only indication of the virus content of the harvested material, this value was compared with (a) titres of pools made of equal quantities withdrawn from the bottles of completed vaccine produced during each day's run and (b) the geometric mean of the titres of these individual

bottles. For the rest of the time, when pools only were made of the day's allantoic fluids, these values were compared with (a) and (b) as before. During December and January, however, samples from each bottle of vaccine were not pooled and therefore comparison with (a) was omitted. The yields were calculated using the reciprocal of the dilution at the end point of the titrations and taking into consideration the degree of concentration employed. The daily yields obtained in this way were averaged arithmetically for each period to give the values listed in Table V.

It must be pointed out that these titrations were carried out by doubling dilutions, and that they were usually done on different days, using different samples of red cells. For these reasons great accuracy is not claimed, but it would appear that the overall adsorption and elution procedures were relatively efficient.

TABLE V

AVERAGE YIELD FOR SEVERAL PERIODS OF PRODUCTION CALCULATED BY DIFFERENT METHODS

Dates of Period	Method Employed for the Estimation of the Titre of the Fluid Harvested Each Day	Method Employed for the Estimation of the Titre of the Vaccine Produced Each Day	Average Yield for Period	
			PR8	Lee
Nov. 9–Nov. 21	Geometric mean of titres of allantoic fluids	Pooled vaccines	42.7	78.8
Nov. 9–Nov. 30	Geometric mean of titres of allantoic fluids	Geometric mean of vaccines	43.7	80.0
Dec. 2–Jan. 31	Titre of pooled allantoic fluids	Geometric mean of vaccines	53.1	92.9
Feb. 1–Feb. 28	Titre of pooled allantoic fluids	*Pooled vaccines	76.0	100
Feb. 1–Feb. 28	Titre of pooled allantoic fluids	Geometric mean of vaccines	73.2	84.6

*Pooled fluids and pooled vaccine titrations carried out at the same time with the same samples of red cells.

It would seem probable that the efficiency of the process increased as time went on (especially in the case of PR8), and at the end was 73-76 per cent with PR8 and 84-100 per cent with Lee. These figures compare very favourably with the small-scale experimental procedures in which the original titre was known, for inspection of Table III will show that on a small scale, using a cell concentration of 0.5 per cent or greater, the overall efficiency with PR8 was 79-83 per cent and with Lee 74-76 per cent.

DISCUSSION

When Francis and Salk (1943) first suggested the use of influenza virus vaccine made by the adsorption of the virus on and elution from fowl red cells, very little was known about the overall efficiency of this procedure. This paper is an account of experiments carried out on a laboratory scale as well as determination of the probable efficiency of the large-scale production. It is somewhat

interesting that yields of very much the same order of magnitude were obtained in both large- and small-scale production. The average efficiency (Lee and PR8 combined) after December 1944 of the large-scale production was 81 per cent while that for the laboratory work was 76 per cent.

Stanley has also carried out experiments in which the overall yields of the red cell adsorption and elution method were determined. He quotes one experiment in which a fluid pool of 150 CCA units per cc. was adsorbed with 0.96 per cent red cells and elution carried out with one-tenth volume of 0.1M phosphate buffer at pH 7.0. The eluate contained 312 CCA units per cc., giving a yield of 29 per cent. In a second experiment, eggs harvested on the same day as those in the first experiment, and therefore of the same original titre, were processed as in manufacture of vaccine by the red cell method, using 0.1M phosphate buffer pH 7.0 as the eluting fluiid. The eluate has a titre of 1038 CCA units per cc., giving a yield of 69 per cent.

Other methods may also be employed for the concentration and purification of influenza virus. The efficiency of the freezing and thawing method described by Hare et al (1942) and by Hirst et al (1942) is almost the same as that reported for the red cell method. The results of Hare et al would indicate that the overall yield by this method averages about 88 per cent under laboratory conditions and 66-71 per cent with pools of 100-200 cc. of fluid.

More recently Stanley has also investigated this method, using 0.1M phosphate buffer at pH7.0 for elution. By concentrating ten times, his eluate contained 1034 CCA units per cc. and his original pool 150 CCA units per cc., giving a yield of 69 per cent.

We have not carried out investigations with differential contrifugation, but Stanely quotes an experiment in which a fluid pool of 150 CCA units per cc. concentrated 59 times gave a suspension with 6,100 CCA units per cc. This too gives a yield of 69 per cent.

Thus it would appear that the efficiency of all three methods is very much the same. The choice of a suitable method for the concentration and purification of influenza virus, therefore, may well depend on other factors, such as chance of contamination, ease of handling, and equipment required.

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PUBLIC HEALTH NURSING IN THE CONTROL OF SYPHILIS AND GONORRHOEA

4. Cases Which Require Special Attention

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1. The Marital Contact

Arranging for the examination of the marital contact is usually best handled by the marital partner. In his own way he explains his condition to his wife and helps her to obtain an examination. In other instances, the district nurse may know that the contact is already under the care of her physician. The nurse explains the situation to the doctor and asks for his assistance in having the contact examined. If neither of these approaches is possible, it will be necessary for the nurse to investigate the marital contact in the same way as she would any other contact but with even more understanding and tact. The origin of contact information, of course, is not to be disclosed.

2. The Girl Interviewed with Parent Present

This is not an uncommon complication in epidemiological investigation. The nurse in this instance must deal with the girl privately. If an interview in the home is not possible, arrangements are made to see the girl outside the home. If the girl shows a willingness to discuss her problems with her mother, this relationship is to be encouraged, but the nurse's dealings must be with the girl herself.

3. The Minor—Child under 16 Years of Age

If the child is mature and understands the situation, it may seem best to deal with the girl directly. If she is willing to have an examination and cooperate, there may be no need to tell the parent. Her relationship in the home may thereby be protected. Careful judgment must be used in deciding this matter. However, if the parent is to be informed, the nurse should refer the parent to the Medical Officer of Health for interview.

Principles Governing the Handling of Syphilis and Gonorrhoea Patients

1. Have the patient alone; insist on this.
2. Establish a sympathetic atmosphere. Let the patient know that you are at ease and that you have time to listen and consider.

This is the fourth of five articles.

3. Talk your patient's language.
4. Put yourself in the background, especially if the patient is weeping or trying to gain her composure. Wait until she is willing to talk.
5. Always relieve the immediate need. Patient management can scarcely be successful if the patient's whole mind is focused on emergent needs which are unanswered.
6. Maintain genuine respect for the patient's personality.
7. Agree with the patient whenever possible.
8. Show approbation and say nice things when you can sincerely.
9. Pick out the favourable elements of the situation.
10. Let the patient know that you have a picture of him at his best.
11. Do not go faster than your patient can travel with you mentally. (Do not take up too many things in one interview.)
12. Plan *with* your patient. Help him make his own decision. Give him the opportunity to make and tell his own plan.
13. Do not attempt to lower your patient's self-respect.
14. Do not humiliate the patient before others.
15. Do not put the patient on the defensive.
16. Do not take advantage of your own position of authority.
17. Do not coerce the patient mentally.
18. Do not argue with an emotionally upset patient.
19. Meet excuses with facts.
20. Finally, quoting Dr. John Stokes, of the University of Pennsylvania: "Syphilis is not brought to a cure by injection of drugs but the uprooting of the disease from its hold upon humanity is done by the eye, the voice, the understanding and sympathetic spirit without which our much gathering of knowledge is but the unliving dust."'

Canadian Journal of Public Health

MULTIPLE ANTIGENS

THE IDEA of mixed, associated, combined or multiple antigens—by whatever designation they may eventually become known in the English language—is not new. Experimentally, it has long been known that animals respond with the production of antibodies to each of two or more antigens injected simultaneously. For example, animals have been specifically sensitized to ten or more antigens at one time. As a practical measure for the production of antitoxins of the gas gangrene group during the war, a combination of toxins was injected into the one horse. There is no known limit to the numbers of antigens that may be included in a multiple antigen.

Typhoid-paratyphoid vaccine has been in use for so many years that one no longer thinks of it as a multiple antigen. The three or more strains in this vaccine are chosen for active immunization against disease conditions which are essentially similar. In another category, however, is the combination of tetanus toxoid with typhoid-paratyphoid vaccine or diphtheria toxoid with pertussis vaccine used by Foley in Quebec and described in this issue of the Journal. Twenty years ago, Ramon of the Pasteur Institute, France, was the first to use a multiple antigen of this nature on a practical basis; namely, T.A.B.T., in the French Army. This same combination with the addition of diphtheria toxoid was adopted for French troops as early as 1935. The reduction of tetanus, virtually to the vanishing point, in the Canadian armed forces through the use of three doses of T.A.B.T., with annual recall doses, stands out as one of the brilliant achievements of preventive medicine.

Closely allied with the effectiveness of multiple antigens is the matter of adjuvants. For example, the response in antitoxin to tetanus toxoid is better in experimental animals when the toxoid is mixed with typhoid-paratyphoid vaccine than with the toxoid alone. It is, however, by no means clear as to what factors are concerned or the physiological mechanism by which they act. It must be appreciated, however, that the effectiveness of T.A.B.T. was undoubtedly in large measure dependent upon the giving of annual recall doses and not necessarily due to the adjuvant effect of typhoid-paratyphoid vaccine. The effectiveness of T.A.B.T. is well illustrated by Dr. Mather's results, presented

at the thirty-fourth annual meeting of the Canadian Public Health Association, which show that virtually 100 per cent of nearly 2,000 persons given the recommended dosage, which included the recall dose, of this antigen has satisfactory levels of antitoxin. In contrast to this group is the result of investigation of prisoners of war from Hong Kong, where the basic dosage of three injections was given, but no recall dose. Approximately 40 per cent showed no measurable antitoxic immunity.

There are important considerations in the choice of the combinations for multiple antigens. Obviously they must be compatible in the sense that the antigenicity of one does not react harmfully on the other. For example, presence of a phenolic preservative as conventionally used in bacterial vaccine has a deleterious effect upon the antigenicity of toxoids. This is, however, a technical matter. The combination must be adapted to the age group concerned. Tetanus and diphtheria toxoids, with or without pertussis vaccine, is suited to infants and pre-school children; the same combination with typhoid vaccine, except under very special circumstances, is not suitable. Further, no combination is justifiable which, because of resulting local or general reactions occasioned by one of the antigens would detract from the popularity of the other. Thus, in the combination of diphtheria toxoid and pertussis vaccine, the former practically never causes reactions in very young children, while pertussis vaccine very commonly does. One must be confident that in the immunization of children against diphtheria which has proven over the years to be very effective, it does not lose popularity through the addition of pertussis vaccine. Dr. Foley has given us the answer in so far as the province of Quebec is concerned and there is no reason to suppose that the same will not hold for the rest of Canada. In his experience the multiple antigen is more popular than diphtheria toxoid alone. The question of recall or booster doses presents certain problems. The whole philosophy of active immunization with diphtheria and tetanus toxoids is firmly based upon the giving of an adequate primary stimulus followed by suitably spaced secondary stimuli. What the ideal time interval between doses may be has not been determined, nor does it necessarily follow that this interval be the same for all antigens. There is good evidence with the combination of diphtheria toxoid, tetanus toxoid and pertussis vaccine that a three months' recall-dose interval is effective in so far as the antitoxin response to the toxoids is concerned; the effectiveness in the case for pertussis vaccine in this regard is not yet known. The data on the practical and effective time interval between the primary and secondary stimulus are incomplete. As children reach school age and beyond, there is little point in recall doses for whooping cough, whereas booster doses are desirable for tetanus and diphtheria.

Finally, the question arises as to the most practical method of recording what vaccines have been given. This is obviously especially desirable in the case of tetanus toxoid. Wristlets or identification discs adequately marked may serve the purpose. A suitable and decorative tatoo on the inner side of the great toe offers certain advantages. The health section of the United Nations might consider it a not too humble undertaking to advise and recommend an international scheme or code.

D. T. Fraser

UNITED STATES-CANADA RESEARCH DEVELOPS VACCINATION AGAINT RINDERPEST*

RINDERPEST has been one of the most important diseases attacking livestock; occurring in serious epidemics, it has involved enormous losses. Extensive outbreaks have always been associated with wars. Epidemics were recorded several hundred years ago in Egypt, from which country it spread to Europe. In one three-year period, one and a half million cattle were stricken. In South Africa the disease has been kept under control by a rigid system of veterinary inspection.

During the war, the threat of the possible introduction of the disease, by accident or by enemy action, was constantly in the minds of authorities in Great Britain, the United States and Canada, as the cattle in these countries were highly susceptible. The U.S. Secretary of War and the Canadian Minister of National Defence therefore named a joint commission to conduct intensive studies and to develop, if possible, means of protection. The following were appointed members of the commission: Dr. J. Craigie, Connaught Medical Research Laboratories, University of Toronto; Dr. R. E. Dyer, National Institute of Health, Washington; Dr. E. B. Fred, University of Wisconsin; Brig. Gen. R. A. Kelser, U.S. Army Veterinary Corps; Dr. C. A. Mitchell, Department of Agriculture, Ottawa; Dr. E. G. D. Murray, McGill University, Montreal; Dr. G. B. Reed, Queen's University, Kingston; and Dr. H. W. Schoening, U.S. Department of Agriculture. Because of the highly contagious nature of the virus and the fear of possible spread, the work was conducted on Grosse Ile in the lower St. Lawrence River. Grosse Ile, it will be remembered, was one of Canada's first quarantine stations, but its use had been discontinued prior to the war.

The work at Grosse Ile was conducted by the following scientists: Capt. James A. Baker, V.C., U.S. Army; Capt. H. K. Cooper, V.C., U.S. Army; Capt. Henry Griffiths, General List, Canadian Army; Lt.-Col. M. W. Hale, V.C., U.S. Army; Capt. Dubois L. Jenkins, V.C., U.S. Army; Major Fred D. Maurer, V.C., U.S. Army; Capt. Thomas C. Robey, V.C., U.S. Army; Cmdr. Richard E. Shope, M.C., U.S.N.R.; and Major R. V. L. Walker, P.L.D.G., Canadian Armoured Corps. Their objective was, first, to prepare a vaccine through which, by immunization, an outbreak could be localized, and, second, to develop a cheaper or more efficient vaccine against rinderpest than those then available. The former methods of vaccination consisted of the use of virus obtained from cattle inactivated by formalin. Only relatively small quantities could be made, and there were other limitations. At Grosse Ile the vaccine was produced by cultivating the virus in fertile hens' eggs. By this method of cultivation, the virus lost most of its disease-producing power but kept its ability to produce immunity. Exposure of vaccinated animals to infection demonstrated that the vaccine was eminently successful in preventing the disease. The work at Grosse Ile was conducted under strict military secrecy and with elaborate precautions against the possible escape of the virus from the laboratory. The vaccine is dried from the frozen state and maintains its potency for as long as fifteen months at refrigerator temperature.

Almost a year before the close of hostilities with Japan, the commission had

**Information supplied by Science Service.*

successfully completed its undertakings. Few pieces of research were more successfully developed than this project, and few will result in greater value to humanity. It has provided a method for the control of rinderpest throughout the world; and in countries where the disease has been prevalent, use of the vaccine will reduce the loss, thereby making available substantially greater supplies of meat, which are so urgently required. One million doses of the vaccine have been given to the United Nations Relief and Rehabilitation Administration for use in China, where rinderpest is the most important cattle disease.

THE TRAINING OF SANITARY INSPECTORS

IT is recognized in Canada that the sanitary inspector has a unique contribution to make to public health. The old conception of the inspector as one engaged primarily in law enforcement has been replaced by that of one accomplishing disciplinary duties through health education. The effective inspector is in every sense a field worker, demonstrating how the essentials of sanitation can be provided, particularly in rural areas. In his duties as a quarantine officer, he is equipped to give intelligent answers in regard to measures which he enforces. In the ispection of restaurants, in housing inspection, and in fumigation, etc., he has the opportunity to give health instruction.

The Canadian Public Health Association can feel fully justified in having undertaken to join with the inspectors in a plan designed to prepare them more adequately for their important duties. The Association has established standards of education and training, and for the last eleven years has held annual examinations for the Certificate in Sanitary Inspection (Canada). During the past four years, instruction has been provided through correspondence courses. To date, 484 inspectors have obtained the certificate, a number representing two-thirds of the inspectors employed full-time in Canada.

During the war, many members of field hygiene sections and other sanitary groups in the services have become keenly interested in sanitary inspection as a peace-time vocation. One hundred and sixty-two candidates, the majority of them ex-servicemen, have been registered for this year's examination. Unfortunately, this interest, though encouraging to the future of public health, has created an acute problem, since it has not been possible to develop local health services in the various Provinces, and more particularly rural health units, at the rate which had been anticipated. During recent months, each candidate has been advised to make careful enquiry in his Province as to opportunities for employment before proceeding to the examination. Even though early employment seemed doubtful, however, many candidates have gone ahead with their plans, indicating that they would seek other employment until an opportunity in sanitary inspection became available.

This situation has given the officers of the Association much concern. It is considered necessary to restrict the acceptance of registrations for the examinations, for at least one year from July 1, 1946, to those candidates who either have served as sanitary inspectors in Canada or have had extensive experience in hygiene services abroad. It is hoped that within the coming year the development of rural health services will be such that the majority of inspectors who are presently awaiting positions will obtain appointments.

NEWS

Establishment of a Medical Research Division in the National Research Council

A DIVISION OF MEDICAL RESEARCH has been established by the National Research Council of Canada to carry on work previously directed through the Associate Committee on Medical Research. Dr. J. B. Collip, Director of the Research Institute of Endocrinology, McGill University, Montreal, and Chairman of the former Associate Committee, has been appointed Director of the Division. Dr. G. H. Ettinger, Professor of Physiology, Queen's University, Kingston, and Honorary Secretary of the former Committee, has been appointed Assistant Director of the Division.

A new Committee on Medical Research has been established for the purpose of advising the Division of Medical Research on questions of policy and with respect to medical problems which should be investigated. Under the new organization of this work, the National Research Council will continue to support medical research mainly in the existing medical schools and hospitals throughout Canada, rather than through the establishment of medical research workers under its own auspices.

The general subject of medical research was sponsored by the National Research Council just before the war at the request of the Canadian Medical Association and the Royal College of Physicians and Surgeons. The first Chairman of the Committee was the late Sir Frederick Banting. Early in 1939 he conducted a survey of research facilities in medical schools and hospitals throughout Canada. He found that workers in Canadian laboratories were both eager and able to undertake medical research problems. The Associate Committee then began to receive suggestions for requirements in respect of medical research and related matters and to make awards of grants-in-aid of medical research in various centres throughout the Dominion according to a carefully prepared and comprehensive national plan.

On the outbreak of war the Associate Committee on Medical Research offered its services through the National Research Council to the Dominion Government in the coordination of wartime medical research. Visits were paid to Great Britain by Sir Frederick Banting in December 1939, by Prof. C. H. Best in 1940 and Prof. W. Penfield in 1941 to learn of needs in which Canadian investigators could help. By 1942 most of the budget and activities of the Associate Committee were concerned with war problems, a situation which continued throughout the war. Free exchange of reports and information with the allies prevented overlapping. Conferences to discuss many problems and progress in their solution were held and these were usually attended by large representation from the United States and frequently from Great Britain and other allied countries.

After the tragic death of Sir Frederick Banting in February 1941, Dr. J. B. Collip became Chairman of the Committee.

Immediately following the outbreak of war, there was a large influx of medical problems from the three Armed Services. In order to meet this situation, the National Research Council established a separate Medical Research Committee for each Service to deal with the medical problems peculiar to the individual Service, and also made necessary arrangements to ensure that there would be no unneces-

sary duplication of effort between these committees, and that each Service concerned would receive full benefit from work done by another committee on problems of common concern. These three Committees were discontinued at the close of the war.

Most of the war problems investigated by the Associate Committee on Medical Research were supervised by four subcommittees, all with members from the Services. The Subcommittee on Shock and Blood Substitutes, with Dr. C. H. Best as Chairman, directed researches through regional groups in Toronto and Montreal on the fundamental nature of shock, on the use of isinglass as a blood substitute, on the preparation, properties, storage and transportation of dried human blood serum, and on methods of preservation of whole blood and red blood cells. It acted as adviser to the Connaught Medical Research Laboratories, the Canadian Red Cross Society, and the Department of National Health and Welfare, in the matter of preparation of dried serum, and to the Royal Canadian Army Medical Corps in the preparation of a film demonstrating the recognition and treatment of shock. It issued memoranda on the "Early Recognition and Treatment of Shock" and on the "Organization and Operation of a Blood Bank".

The Subcommittee on Infections, Dr. Duncan Graham, Chairman, organized researches on the diagnosis and treatment of wounds infected with gas gangrene and other organisms, and pioneer experiments on the local application of sulphonamides. It advised on the production of typhus vaccine and Shiga toxoid, and made suitable recommendations to the Department of National Defence concerning their use. It instituted experiments on methods of production and use of penicillin, and aided in the preparation of an influenza vaccine. It advised the Department on questions of bacteriological significance.

The Subcommittee on Surgery, Dr. Wilder D. Penfield, Chairman, supervised researches through Regional Groups in Montreal, Toronto, London and Winnipeg, and through Sections on Burns, Orthopaedics, Plastic Surgery, Surgical Radiology, Thoracic Surgery, and Traumatic Injuries of the Nervous System. The Subcommittee arranged important conferences in which surgeon-specialists, both in the Services and in civilian practice, in Canada and from abroad, were called together to consider these matters, and memoranda on certain special subjects were issued by the National Research Council.

The Subcommittee on Industrial Hygiene and Industrial Medicine, Dr. D. Y. Solandt, Chairman, was concerned mainly with health problems in industries active in the manufacture of munitions and supplies.

The Associate Committee also provided the Department of National Defence with recommendations in respect of nutrition and prepared a memorandum on problems of nutrition in Canada, which was submitted to the Ministry of Food, and the Medical Research Council, Great Britain.

In carrying out the foregoing program of medical research, the Associate Committee had the co-operation and assistance of several hundred leading physicians and surgeons, throughout Canada, who were keenly interested in this subject. Their able and willing contributions enabled the Committee to plan and direct medical research during the war on a high level of efficiency and it is not surprising therefore to find that the work has now been so well established as to warrant the creation of a permanent Division of Medical Research within the organization of the National Research Council. Under the new arrangement the existing need for expansion can be met and continuity of research from year to year in selected fields will be provided for on a permanent basis.

Cancer Control in the U.S.A.

THE BLUEPRINT for an accelerated cancer-control program is provided in a report on cancer facilities and services just released by the United States Public Health Service. Prepared by a committee of the National Advisory Council, the report contains specific recommendations concerning medical education and control programs for the disease which to-day ranks second as a cause of death in the U.S.

The special committee was appointed in November, 1944, by Dr. Thomas Parran, Surgeon General of the United States Public Health Service, in anticipation of a postwar increase in cancer-control activities. The recently completed report of this committee is presented in four parts: Medical Education in Cancer, Basic Elements of a Cancer Program, Basic Information for Use in Studying and Planning State Cancer-Control Activities, and Summary Recommendations.

Recommendations made by the committee include those for more comprehensive and better integrated courses in cancer at medical schools; an increase in the number of centres prepared to give postgraduate training in cancer; and the continuation and expansion of the various kinds of cancer-education activities for practising physicians that have been conducted in a number of communities.

The committee further recommends that the National Cancer Institute aid in the development of a few cancer centres strategically located geographically, associated with one or more medical centres, and available to any patient regardless of ability to pay. It is suggested that such centres would serve as guides in developing plans that could be applied anywhere in the country to insure to cancer patients the best that medical science has to offer in the way of diagnosis and treatment.

Expansion of the research work of the National Cancer Institute is advised, including the training of research fellows and the program of grants to aid research in other institutions. Also recommended is assistance from the National Cancer Institute to State health departments and other agencies in developing programs which will make available in a State an adequate cancer service.

The report describes the basic elements of such a service as statistical research to determine the extent of the cancer problem; educational activities for doctors, dentists, nurses, and the general public; medical facilities and services, including cancer prevention or detection clinics, tissue diagnostic services, diagnostic and treatment clinics (one for approximately 50,000 population), an adequate number of hospital beds, and facilities for the care of the advanced cancer patient either in his own home or an appropriate institution.

Close co-operation is urged between the National Cancer Institute and voluntary agencies in the development of cancer-control activities.

It is further recommended by the committee that if present legislation does not give the National Cancer Institute the authority to carry out the committee's recommendations, additional legislation and necessary appropriations be requested.

The members of the committee responsible for the report were Dr. George M. Smith, Yale University School of Medicine; Dr. Frank Adair, Memorial Hospital for the Treatment of Cancer and Allied Diseases, New York City; and Dr. Sherwood Moore, Mallinckrodt Institute of Radiology, St. Louis, Mo.

Dr. Dublin Appointed Officer of the Order of Public Health

DR. LOUIS I. DUBLIN, Second Vice-President and Statistician of the Metropolitan Life Insurance Company, New York, has been named an Officer of the Order of Public Health of the Republic of France, by decree of the Office of the Ministry of Population.

The honour is in recognition and appreciation of a survey of child health and other health problems carried on in France by Dr. Dublin as representative of the American Red Cross during the fall of 1945.

Prior to his mission in France, Dr. Dublin was loaned by the Company to the Red Cross to serve as full-time assistant to Basil O'Connor, chairman of the organization during parts of 1944 and 1945, and during the absence of Mr. O'Connor overseas, he was acting head of the Red Cross in the United States. He also served with the Red Cross during World War I as a member of commissions in Italy and in the Balkans.

Graduate Organization of the School of Hygiene

A GRADUATE ORGANIZATION of the School of Hygiene, University of Toronto, was formed by members attending the thirty-fourth annual meeting of the Canadian Public Health Association. Dr. Leo Sturgeon (D.P.H. '45) was elected chairman and Dr. J. H. Baillie (D.P.H. '41) secretary. It is planned to notify all graduate members that they are automatically members of the organization. A membership fee is not contemplated.

The first meeting of the organization is planned in conjunction with the November convention of the American Public Health Association in Cleveland, if facilities are available.

The executive believe that the successful operation of this group depends entirely upon the contributions and suggestions that they receive from the members, and both the chairman and the secretary are anxious to hear from members in this regard.

Alberta

THE DIVISON OF PUBLIC HEALTH NURSING held its annual spring refresher course on April 22, 23 and 24 with approximately fifty staff nurses in attendance. This number included district nurses, child welfare clinic nurses, and nurses from one-nurse health units. Common problems in regard to immunization, public health entomology, infant feeding, records and office administration, tuberculosis control, school examinations and sanitation received a thorough going-over at the hands of the group, under the guidance of experts in these fields. As in other years, the conference proved its worth in that each nurse went back to the field with her program clarified and many of her problems at least partly on the way to solution.

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A UNIVERSITY REFRESHER COURSE in sanitary inspection was held from April 22 to 27 under the direction of the Provincial Department of Public Health in co-operation with the Faculty of Agriculture and the Department of Extension of the University of Alberta. The purpose of the course was to familiarize sanitary inspectors, through the use of lecture, laboratory and discussion periods, with the basic principles of sanitary inspection as applied to conditions in this Province. An outstanding feature of the program was a discussion concerning food-handling establishments and beverage rooms, with representatives from the Hotel and Restaurant Employees' Union, The Alberta Restaurant Association, the Alberta Liquor Control Board, and the Alberta Hotelkeepers' Association in attendance.

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A HEALTH INSURANCE ACT has been passed by the Alberta Legislature in order that the Province may be in readiness to take advantage of the Dominion proposals at such time as they may be implemented.

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COMPULSORY PASTEURIZATION BY-LAWS are now in force in the towns of St. Paul, Vegreville and Ponoka, while a number of other centres have 100 per cent pasteurization without the exercise of a by-law. Some of the latter are Calgary, High River, Olds, Camrose and Lacombe.

DR. MALCOLM R. BOW, Deputy Minister of Health, attended the meetings of the Canadian Public Health Association in Toronto and the Dominion Council of Health in Ottawa, in May. Dr. G. M. Little, Medical Officer of Health for Edmonton, and Dr. W. H. Hill, Medical Officer of Health for Calgary, also attended the meeting of the Canadian Public Health Association.

Manitoba

FIVE NEW HEALTH UNITS were opened in Manitoba in May. The units and their directors are: Selkirk, Dr. G. D. Caldbick, D.P.H.; Stonewall, Dr. E. J. Cram, D.P.H.; Neepawa, Dr. J. H. Preston, D.P.H.; Flin Flon, Dr. F. R. Chown, D.P.H.; and Virden, Dr. Wm. Fowler, D.P.H. This makes a total of thirteen full-time health units in the Province.

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DR. MAXWELL BOWMAN has resigned as Assistant Professor of Social and Preventive Medicine at the University of Manitoba Medical College in order to devote his whole time in the Department of Health and Public Welfare as Director of Preventive Medical Services.

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MISS W. J. MOYLE has been loaned to the Manitoba Department of Health and Public Welfare by the Department of National Health and Welfare to make a survey of the food departments of small hospitals throughout the province.

Retirement of Colonel Sharman

COLONEL C. H. L. SHARMAN, C.M.G., C.B.E., of Ottawa, who since 1927 has been Chief of the Narcotic Division of the Department of National Health and Welfare, has retired after forty-eight years in government service. In what is believed to be a unique tribute from the officials of one country to a colleague in the service of another government, officers of the United States Bureau of Narcotics marked his retirement by presenting him with a watch in appreciation of his "very great help under many trying circumstances". In requesting the Canadian Ambassador in Washington to transmit the gift, the Hon. H. J. Anslinger, United States Commissioner of Narcotics, said that his department had always highly respected Colonel Sharman's valuable counsel and had benefited by his unfailing devotion to difficult tasks which have confronted both services. Prime Minister King, in forwarding the gift, paid tribute to Colonel Sharman's distinctive service on international commissions and to his extraordinary record of public service.

Colonel Sharman was born and educated in England and came to Canada in 1898, joining the North West Mounted Police. In 1903 he went to Ottawa to join the newly organized Health of Animals Branch of the Federal Department of Agriculture, with which he remained until 1927 when he became associated with the Department of National Health.

He served in the South African War and, after going to Ottawa, with the Canadian militia. In 1914 he took command of the First "Ottawa" Battery, Canadian Artillery, overseas and was wounded at the second battle of Ypres. Later he commanded a brigade of artillery on the expedition sent to Archangel. For his wartime services he was made a Companion of the Order of St. Michael and St. George, and a Commander of the Order of the British Empire, and received the Order of St. Vladimir from the Russian Government.

In 1931 and 1936 Colonel Sharman was one of Canada's delegates in negotiating international agreements relating to narcotics and since 1934 has been Canadian representative on the League of Nations' advisory committee on the traffic in opium and other dangerous drugs. Arrangements have been made for him to represent Canada on the narcotic drug commission established under the Economic and Social Council of the United Nations.